

Claims

1. A material strength measuring and evaluating method for measuring and evaluating a peel strength and/or a fragility breaking strength of a fragile thin film, said method being carried out by detecting charged particles and comprising the steps of:

pressing an indenter into a test object and measuring an indentation load as well as an indentation depth, while at the same time detecting charged particles emitted from a peel starting point or a breakage starting point; specifying a peel occurring time and a fragility breaking time when charged particles are increased; measuring a peel strength and/or a fragility breaking strength.

2. A material strength measuring and evaluating method by detecting charged particles according to claim 1, wherein the test object is formed by a substrate and fragile thin film covering the substrate.

3. A material strength measuring and evaluating method by detecting charged particles according to claim 1, wherein the test object is positioned horizontally and the indenter is vertically pressed into the surface of the test object.

4. A material strength measuring and evaluating method by detecting charged particles according to claim 1, wherein the test object is arranged to form a tilt angle with the pressing direction of the indenter, so that the indenter is pressed in a direction inclined with respect to the surface of the test object.

5. A material strength measuring and evaluating method by detecting charged particles according to claim 1, wherein when charged particles are collected by a charged particle collecting element, an electric potential having a polarity different from that of the charged particles to be collected is applied to the charged particle collecting element.

6. A material strength measuring and evaluating apparatus which functions by detecting charged particles, said apparatus comprising:

a sample mounting base for mounting a test object; an indenter to be pressed into the test object; a charged particle collecting element disposed in the vicinity of the front end portion of the indenter and formed integrally with or independently from the indenter; an indentation load detector for detecting an indentation load of the indenter; a displacement detector for detecting a displacement amount of the indenter; a signal processing system for measuring a peel

strength at the time of peel occurrence and/or a fragility breaking strength at the time of fragility breaking, in accordance with the output signals fed from the indentation load detector, the displacement detector and the charged particle collecting element.

7. A material strength measuring and evaluating apparatus which functions by detecting charged particles according to claim 6, wherein a sample setting surface on the sample mounting base is changeable between a horizontal state and an inclined state.

8. A material strength measuring and evaluating apparatus which functions by detecting charged particles according to claim 6, wherein the front end portion of the indenter is formed by a diamond, a sapphire or a piezo-electric material.

9. A material strength measuring and evaluating apparatus which functions by detecting charged particles according to claim 6, wherein the indentation load detector is an electronic balance positioned below the test object.

10. A material strength measuring and evaluating apparatus which functions by detecting charged particles

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according to claim 6, wherein the displacement detector is a light reflection intensity meter or a light interference meter each capable of measuring a relative displacement of the indenter with respect to the test object.